

FLUID CONTROL AND ALERT DEVICE USING SMART PHONE

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ABSTRACT

During recent years due to technological advancement many sophisticated techniques has been evolved for assuring fast recovery of the patients in the hospitals. For good care patient in the hospitals assessment and management of patient's fluid electrolyte need is the most fundamental thing required. All most in all hospital an assist/nurse is responsible for monitoring the fluid level continuously. But unfortunately during most of the time, the observer may forget to change the saline bottle at correct time due to their busy schedule this may leads to several problems to the patients such as backflow of blood, blood loss etc. To avoid this critical situation a low cost embedded based automatic alerting and indicating device is proposed where IR sensor is used to measure the flow of fluid and level of the fluid is measured using level sensor. The keyboard and smart phone used to increase and decrease the flow of fluid. This information can viewed in the mobile or LCD display.

Keyword - automatic fluid control; saline monitoring; level indication; controlling device; arduino mega; android

I. INTRODUCTION

The requirements for health care are rapidly rising with the continuous growing of the world of the world population. Numerous technological innovation designs are taken for the advantages of medical service improvements. There have been researching and development of saline monitoring and controlling device for betterment of people's health care. The intension of this functionality is to aid the regular life of a affected person through developing an automated and price efficient saline tracking and controlling method because it is necessary to control the saline flow rate for different patient as circulation flow depending on physical conditions such as heart rate as well as pulse rate, heat range of patient's body, body mass, and blood pressure level of the patient.

The main objective of this paper is to demonstrate an automated saline flow monitor control which is able to measure the saline drop rate and also can able to control the flow rate. It is a automated saline supervising method useful for the

physicians to keep track of the circulation by only pressing keypad considering exactly how many drops required per minute. This decreases the constant on-site tracking by the physician or health care worker. And also if saline level is going to be end the level sensor sense and the flow is stopped. Regular saline is usually called as a sterile solution of sodium chloride (NaCl) in standard water. Regular saline is frequently used in intravenous trips (IVs) or the patients who are not able to have liquids by mouth as well as tend to be in treat of leading to dehydration or hypovolemia. Regular saline consists of 9 grams of NaCl, and also the osmotic agent of NaCl is usually 0.93.

The quantity of regular saline consumption by the patient completely relies upon the physical state of the patient but usually, it is among 1.5 to 3 liters per day for a mature person. Normally the saline stage is checked by the nurse staff and patient's family members. The primary goal of the proposed techniques is to offer dependable medical, hassle-free, simple and easy as

well as a cost efficient method of saline level controlling.

II. OVER VIEW OF PROPOSED SYSTEM

Some monitoring device has been developed using the android smart phone, Zig Bee and IOT. In all the previous system it was seen that there is no automatic control of flow rate using smart phone Technology development is an ultimate aim in all sectors. Especially, more new technologies are emerging in medical field for the betterment of people and to serve the society. The proposed Arduino based indicating device acts as an assist to nurse and doctors in monitoring the patients. An effective idea is proposed to develop an effective health monitoring system which alerts the doctor or nurse when the fluid level of saline bottle is beyond the threshold limit and automatically stops the flow when the saline level is reached it's minimum level.

It comprises of IR sensor, Level sensor, keyboard, servo motor, LCD etc. This also reduces the stress of repeated checking about the status of IV set. It also has an appreciable advantage such as small size, affordable cost, and high accuracy, easy handling and completely automated. Certainly, this device reveals a good change in medical field especially in patient monitoring system with less initial investment if implemented in real time work.

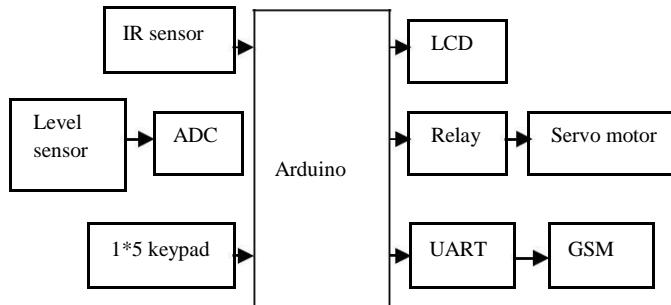


Fig.1. Block diagram of proposed automated fluid control device

III. CONSTRUCTION AND WORKING OF PROPOSED SYSTEM

The system has been implemented using Arduino UNO platform based on ATmega328 contains 14 digital input/output pins, 6 analog inputs, a USB connection, a power jack, and a reset button. A keypad 3x4 has been interfaced with the developed system for giving the command to the

user along with the 16x2 LCD monitor to monitor the information about the current flow rate. The system has employed a Bluetooth module for pairing an Android mobile device to receive the command from Android paired phone. IR sensor will detect drops of liquid and the detected signal will be transmitted to the microcontroller.

The microcontroller will calculate the time between two drops to determine drop per second and give the command to LCD display for displaying the fluid flow rate. According to the command given by the user via smart phone/keypad, the microcontroller will compare the given command with actual flow rate.



Fig 2. Experimental setup of saline monitoring

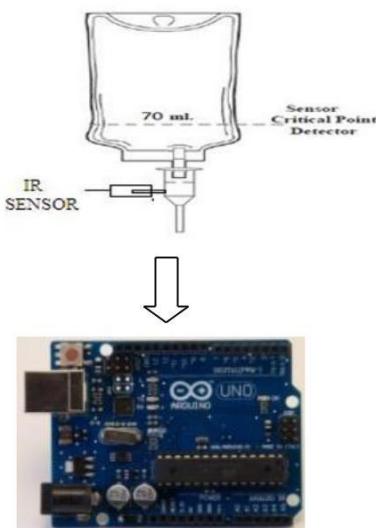


Fig 3. Hardware arrangement

According to the command, the microcontroller will control the servo motor to rotate a valve clockwise or anti-clockwise rotation to increase or decrease the gap between valve and pipe for controlling the liquid flow. The valve will be mounted on the shaft of the servo and able to increase its depth smoothly from 0° and become about the diameter of the saline pipe at 180° . When the servo will rotate from 0° to 180° the saline pipe will be pressed and released to control the liquid flow.

From the measurement, it was found that:

The internal diameter of saline pipe, $d_1=2.5\text{mm}$

Total diameter of saline pipe, $d_2=4\text{mm}$

Thickness if the pipe layer, $=1/2(d_2-d_1) = 0.75\text{mm}$

Thus pipe thickness after compressed= $(d_2-d_1) = 1.5\text{mm}$

The depth increased per unit angle= 0.00833mm per degree

Table1. Commanded flow rate (drop/min) and peak time (s)

NO.	Commanded flow rate(drop/min)and peak time(s)	
	Command in drop/minute	Peak time in second(T_p)
01.	70	2.1
02.	90	2.6
03.	130	3.3
04.	320	5.2
05.	500	6
06.	700	6.4

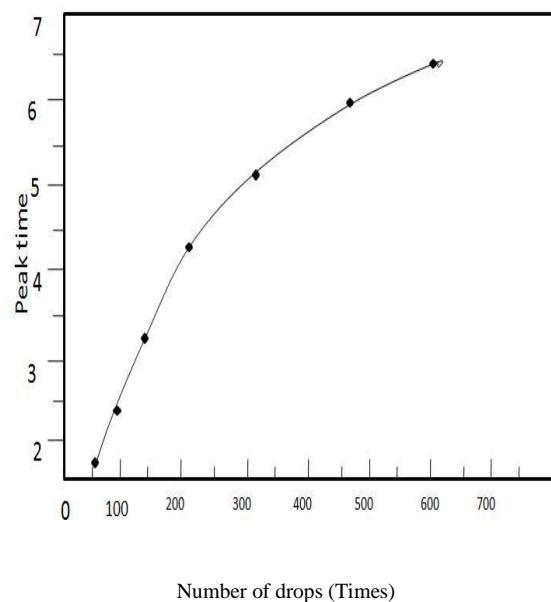


Fig.4. Relation between recommended flow rate and peak time

IV. SOFTWARE DESIGN

An android app has been developed using Android studio for pairing the smart phone with the developed system. Programming of the microcontroller is developed based on the flow chart shown in the figure3. The flow chart of fluid control device shows that at first, the Arduino is needed to give the command to the display and GSM module to show the text “enter the number of drop per minute” on an android phone so that user can enter the number of drop per minute as wish. After entering the number Arduino continuously reads the flow sensor. When the sensor detects the first drop, the timer starts time and when the next drop will be detected by sensor, the timer will stop the time.

Time will be calculated per minute and it will be compared with flow rate given by the user. When actual flow rate has been greater than the command then servo has rotated anti-clockwise to reduce the flow rate and if the actual flow rate has been less than the command then servo has rotated clockwise to reduce the gap between valve and pipe. When both have been equal, servo has remained stop. If the saline level is going to be end the servo rotates anti-clockwise and stop the flow completely.

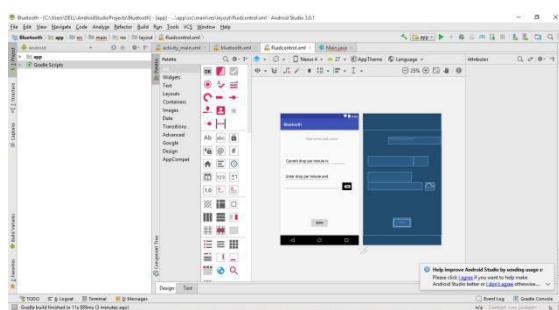


Fig.5.Android application preview

V. EXPERIMENTAL RESULTS

Monitoring of present liquid flow rate has been done using LCD monitor and also the flow rate information has been shown on the smart phone. Android phone and the keypad has shown the capability to input the command by the user according to the requirement. When the user has pressed the start button, the microcontroller has read the IR sensor.

When the drop has been detected by the sensor, the timer has started to count time and at the same time microcontroller has started to read the sensor for detecting the next drop. When next drop has been calculated at the same time. The actual fluid flow rate has been compared with the flow rate commanded by the user. The program has been continuously read the sensor and calculated the flow rate.

The flow rate has been continuously compared with command given by the user and kept both equal by rotating the servo in clockwise/anti-clockwise. The device would wait until the command was given by the user. After pressing the START button by the user, the device would start to read the sensor to detect the drop and calculate the flow of fluid. Table 1 is showing that the commanded flow rate (drop/min) and peak time(s).

VI. CONCLUSION

Due to the combination of the two important disciplines of medicine and engineering, the medical facility and treatment have achieved a rapid advancement and development. The main difficult was to design a device which responses

correctly as well as rapidly and design of sensor to detect the fluid drop. However, in this work, the IR sensor is very sensitive and can detect any type of fluid and responds very quickly as compared to the other sensors available in the market. The device can be used in medical application as well as in the chemical lab where the very accurate flow of fluid is required. This system can be designed at very low cost and every part is available in the market. Once the command is given to the device it keeps the flow rate constant regardless of the level of water from the patient.

VII. REFERENCES

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